

SCIENCE

FRIDAY, OCTOBER 12, 1888.

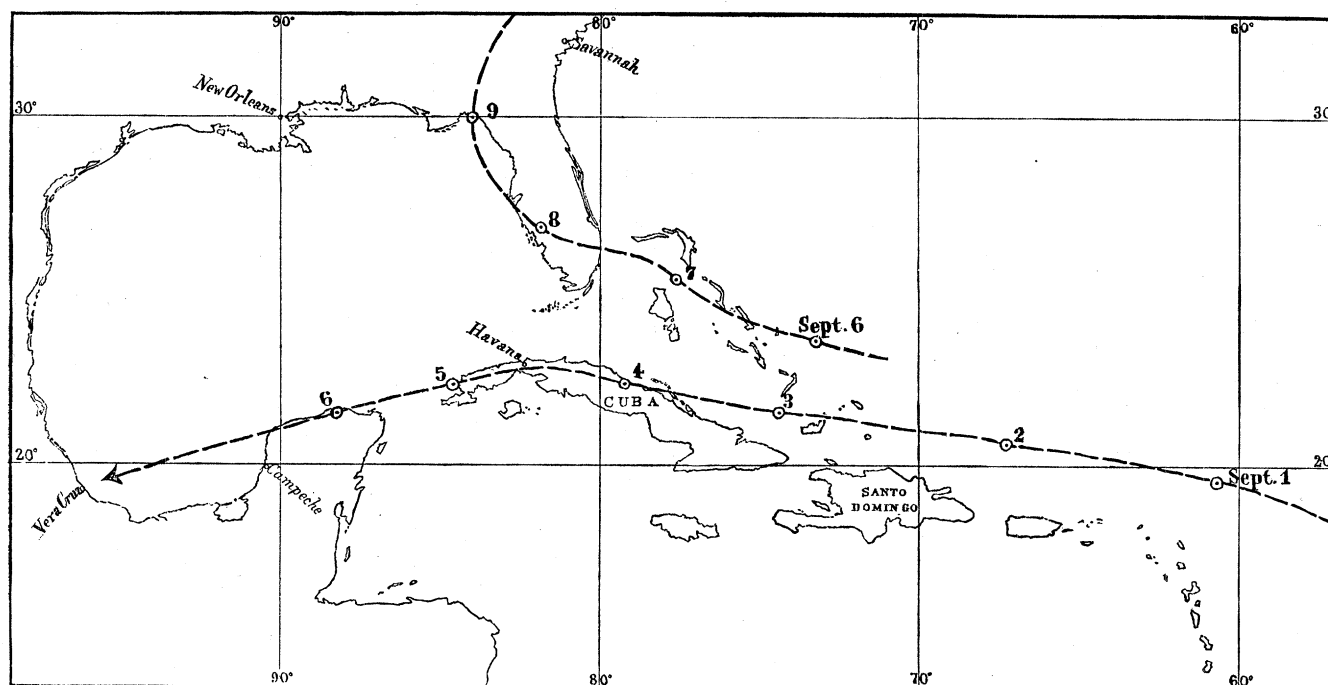
THE SUNDRY CIVIL APPROPRIATION BILL, passed by Congress, has finally been signed by the President, and the grants of money it makes have become available. Among these is one of a hundred thousand dollars, to enable the United States Geological Survey to begin an inquiry in regard to the feasibility of reclaiming the arid lands of the Far West. The sum is not as large as might be profitably used for this purpose, but it will enable a beginning to be made and an organization of the work to be effected. The amount of progress that may be made between now and July, 1889, is much less important than the determination reached by the government to enter upon this great work. This has not been hastily

SCIENTIFIC NEWS IN WASHINGTON.

The Cuban Hurricane. — Tree-Growth on Arid Lands: Forests have Little Effect upon Climate: They do promote Agriculture.

The Cuban Hurricane.

MR. EVERETT HAYDEN of the Hydrographic Office, whose visit to Cuba for the purpose of studying West Indian hurricanes has been mentioned in a previous number of *Science*, reports to the Hydrographic Office that upon his arrival at Havana he placed himself in communication with the Rdo. Padre Benito Viñes, of the Observatory of the Real Colegio de Belen, who has done every thing in his power to facilitate his work. Assisted by this eminent meteorologist, Mr. Hayden immediately began the investigation of the great hurricane that caused such destruction in the island of



TRACK OF THE CUBAN HURRICANE.

done, or without a full comprehension of the ultimate magnitude of the undertaking, or of the vast possibilities involved in it. The subject was very ably discussed, both in the Senate and House of Representatives, and, what is very remarkable, the debates took place at a time when the political excitement that pervaded both bodies was so great as almost to preclude the consideration of any new question of as great importance as this. It may not be that the amount of land that can be reclaimed from present worthlessness, and converted into rich agricultural lands, will equal in extent the entire area now under cultivation in the United States, as Major Powell has estimated; but, if one-half of this result is realized, the wealth of the country will be increased as it never has been increased before. Homes will be provided for additional millions of industrious people, and the amount of the natural products of the country will be increased almost beyond our present comprehension. It is an appreciation of these facts that causes us to consider the determination of the government to enter upon this great enterprise as the most important public business of the present year.

Cuba from the 3d to the 5th of September. One of the first features, and probably the most remarkable, noticed, was the exceptional and wholly unexpected change of direction in the onward movement of the cyclone on the night of the 4th, from about west by north to the south of west. Such a marked departure from the paths usually followed by these storms in low latitudes at once excited the curiosity both of Padre Viñes and the Hydrographic Office. The cause of this phenomenon seems to have been the presence, not far to the eastward, of another well-defined hurricane, which apparently exerted a marked influence upon the first and more violent one. This influence was shown in a variety of ways, but the details of its operation are still a subject of some uncertainty. According to Viñes, two barometric depressions, starting at about the same time and in the same neighborhood, exert a repellent influence upon one another in the upper currents. The reason assigned is, that the air, after rushing to the centre of the cyclone, rises rapidly, as in a sort of funnel, and when the top is reached (i.e., when, having reached an atmosphere of its own temperature, there is no longer a tendency to rise) the currents flow radially outward towards the circumference of the cyclonic area; and, when two depressions are near enough, these upper currents will meet and repel each

other. Viñes admits, however, that the currents at the surface of the earth tend to make the barometric depressions converge and unite.

In accordance with this theory, the upper currents of these two great barometric depressions met and caused the divergence in the two storms, — one to the south and west, the other to the east and north.

The theory at present favored by the hydrographer, while not denying the possible influence of upper currents, according to that of Viñes, takes into consideration only the surface currents as furnishing sufficient data to explain the phenomenon. Briefly stated, it is to the effect that an energetic area of high barometer was central over the Middle Atlantic States during the occurrence of the two cyclones, the second of which caused the extensive southward rush of air from the high area to impinge against the first low, instead of encircling it. The natural result to be expected from this would be the forcing of the latter to the southward, which actually took place. In addition to this, a third low area is stated to have passed westward over Jamaica on Sept. 3; and this might have tended still more to draw the first low (the great hurricane) towards the south, on the principle that adjacent depressions of the barometer on the earth's surface have a tendency to converge, — a theory favored by Viñes, as noted above.

The results of the labors of the Hydrographic Office promise to be of great interest and value to both meteorologist and mariner, in connection not only with the great storm which has just occurred, but with regard to hurricanes in general.

Trees on Arid Lands.

Major J. W. Powell, director of the United States Geological Survey, has written the following interesting letter to the *Kansas City Times*, thus making a valuable contribution to the discussion of the subjects of forest-growth on arid lands, the effects of hot winds, and the extent to which irrigation may change the agricultural climate of the plains: —

"The plains are treeless because they are arid. There is an opinion widely existing in the popular mind, and springing up in the current literature of the West, which is opposite to this, to the effect that the dryness of the climate is the result of the lack of forests. An argument in favor of tree-planting and forest-culture has often been based on this error. The effect of forests upon rainfall has been investigated by many methods, in many countries, and at many times, and the result of all this investigation shows that the presence or absence of trees influences the general rainfall or amount of precipitation only to a very limited degree. It is, in fact, not certain that their presence does increase rainfall; but it is certain, that, if it does, the increase is so slight as to play but an insignificant part as a climatic factor.

"Yet forests, or abundant trees, exert an influence upon climate in its relations to agriculture. Two ways in which this influence is exerted are worthy of careful consideration.

"First, While it is not probable that forests diminish or increase the total amount of rainfall in any country, yet it appears that forests regulate this rainfall, so that there are fewer fierce storms and more gentle rains. When the rains fall in storms, the water is speedily gathered into streams, and at once passes from the country; but, when they fall in gentle showers, time is given to moisten the soil and invigorate vegetation.

"Second, Forests provide against the speedy evaporation of the water by protecting the lands from the fierce rays of the sun, and more especially by protecting the land from the rapid passage of dry winds, which drink up the water from the soil and growing plants with great avidity.

"It is manifest that the effect of the forests upon the great movements of the atmosphere must be very slight when due regard is given to proportions between cause and effect. Forests can affect only the winds close to the earth by creating a friction at the surface; but the soil, and the smaller plants growing therein, may be greatly sheltered by trees. Though the general climate may be scarcely affected, the agricultural climate may be materially modified.

"The relation of forests to humidity, and of prairies and plains to aridity, should be clearly understood. In middle latitudes, and

under average conditions of relative humidity, low, gnarled forests will be produced with about ten or twelve inches of rainfall; that is, in the Rocky Mountain region, and generally on the Great Plains, forests of cedar and pinon can be produced with a little more than ten inches of rain annually. Now, this is a well-established fact. Why, then, are the arid valleys and Great Plains treeless? The answer is, that the fires destroy the trees, and prevent their growth. In a region of great humidity, say, of forty inches or more of rainfall, forests are largely protected from fire by such general humidity. In regions of country having from ten to twenty-five inches of rainfall, all forests are destroyed unless protected by art or topographic position. In regions having between twenty-five and forty inches of rainfall, prairie-lands interspersed with timber-lands will usually be found; that is, in ordinary seasons, trees will be protected from destructive fires by the general humidity, but in excessively dry seasons the trees will be destroyed, now here, now there: so that, by the natural process of tree-propagation, the forests will encroach on the prairies, and through the fires of excessively dry seasons the prairies will encroach on the forests; and so prairie conditions and forest conditions forever contend with each other for the possession of a sub-humid land. In the direction in which aridity increases, prairie conditions will more and more prevail; and, as humidity increases, the forest condition will more and more prevail. In general it may be stated, that, other things being equal, the dryer the climate, the smaller the forests; the wetter the climate, the greater the forests; for, although the rainfall may be sufficient to grow forests, it may not be sufficient to protect them from fires. The Great Plains and the valleys of the Rocky Mountains are all capable of sustaining forests of certain trees adapted to the climatic conditions found therein.

"It is possible, and in due time it will be practicable, for man to clothe the naked lands of the Great Plains and the arid valleys of the West with forests without artificial irrigation. From this must be excepted certain desert-lands west of the lower portions of the Colorado River, where the rainfall is insufficient, and also certain tracts of bad-lands which will always be treeless for reasons that need not here be described.

"The amount of rainfall necessary to produce forests in any given latitude will depend to some extent upon the character and conditions of the soil, some soils needing more rain than others for this purpose; but the soil condition has narrow limits.

"If it be true, as has been asserted above, that the arid plains and valleys may all produce forests without artificial irrigation if protected from fires, how are such forests to be planted, in what manner can they be protected, and how shall the trees adapted to the climate be selected? These are the practical problems to be solved.

"Great areas of uninhabited land cannot be redeemed and protected: the protection must come from men living on the land, and utilizing it for agricultural and pasturage purposes. The way in which this can and will be done may be briefly and crudely sketched as follows: —

"Adown the valleys and across the plains flow many streams of water — brooks, creeks, and rivers — that have their sources in the mountains by which the arid lands are dissected; and all of these streams can be utilized to irrigate the dry and parched lands that now present the desolation of deserts. By their use many tracts of land scattered far and wide throughout the whole country may be brought under cultivation, and covered with growing fields and luxuriant groves. In this manner populous and prosperous settlements may be distributed throughout that land of drying winds and scorching suns. When industrious and thrifty people once get a foothold in this manner, they plant orchards and vineyards, and surround their farms and fields with trees, and plant them by the roadside, and every man devotes a part of his farm to timber-culture, and the naked lands are speedily covered with a rich vegetation. A generation ago the prairie region east of the Missouri River was so destitute of forests that large districts were supposed to be practically uninhabitable; but since that time it has been covered with orchards, vineyards, and groves, and now, from the lands that were once so naked, millions of trees spread their branches to the breezes. In the same manner, by means of artificial irrigation, great numbers of tracts of land will be cultivated throughout the

arid country, and diversified groves will be developed. But not all the arid lands can be redeemed, as the water of all the living streams is inadequate to the task; but the intervening land will be utilized for pasturage purposes, and will be protected by the people from fire, and groves will be planted, and the face of the country not under cultivation will be forested.

"In the region practically uninhabited the water now flows from the mountains to the sea; but, when the streams are utilized in irrigation, the water will be evaporated, and the humidity of the climate will be increased thereby, and dry winds will no longer desiccate the soil and shrivel the vegetation. As the general humidity is increased, the moister air, as it drifts eastward in great atmospheric currents, will discharge more copious rains, and the humid region will extend farther westward, and the arid region will correspondingly shrink in its proportions. Irrigation will increase the humidity of the climate, and increase protection from fires to the non-irrigated lands; and, as the lands gain more and more water from the heavens by rains, they will need less and less water from canals and reservoirs. When all the water of the arid country is ultimately appropriated for irrigation by using all the streams through the season of irrigation, and by storing the surplus that flows through the non growing season, and by collecting in reservoirs the storm-waters of the streamless valleys, the general humidity of the atmosphere in the arid region will be increased, and hence the rains will be increased, and a smaller amount of artificial irrigation will be needed. By all of these means a large share of the arid lands will be redeemed. But all will not be redeemed: there will still be extensive areas of pasturage-lands not under the plough, for all that man may do will be insufficient to radically change the climate. The non-irrigated lands can be greatly improved by extensive tree-planting; but as these trees are to be supported by the general rainfall, which is scant, it will be necessary to select trees adapted to arid conditions, and this will require extensive experimentation. The wide distribution of the cedar, and of the pinon or nut-pine, throughout the country under consideration, points out the fact that these two trees may be widely used; but there are many others on the Pacific coast which perhaps will be more valuable; and it will probably be found that there are many trees in the arid lands of the eastern hemisphere which can be introduced with advantage. But this tree-planting is a question of a somewhat remote future. At present the trees planted in the arid region will depend for their existence and vigorous growth upon irrigation, and the experiments demanded at the present time must be with such trees.

"The great currents of air which now traverse the plains are impelled by agencies that produce the general circulation of the atmosphere throughout the globe, modified by the general configuration of the plains in its relation to the mountains of the West and the low humid lands of the East. These general conditions cannot be modified by man; and the storms will come and the winds will blow for ages as they now do, unchanged by the puny efforts of mankind; and yet the agricultural conditions of the country may be greatly modified and improved by the efforts of man. Man cannot change the great laws of nature; but he can take advantage of them, and use them for his purposes.

"There is a theory held by some persons in the West that rainfall is largely dependent upon the electrical conditions of the atmosphere, and that these conditions are modified by the various changes wrought by the hand of man in the settlement of the Great Plains. As this appeal is to some occult agency, it becomes quite popular to those who love to revel in the mysteries of nature. Of course, it is never explained. It is a case where cause and effect are confounded. Atmospheric electricity is the result of certain conditions and movements in the atmosphere. To explain atmospheric changes by attributing them to electricity is like explaining the origin of the fire by the light it produces, or like explaining the explosion of the powder in the cannon by attributing it to the roar which may be heard in the distance. The electricity in the air is related to atmospheric changes as effect is related to cause.

"In conclusion let it be said, first, that a large body of the arid lands can be redeemed by irrigation, and that the agriculture resulting therefrom will be in the future, as it has ever been in the past, the highest condition of agriculture, for the agriculture which

is dependent upon rains is subject to storms on the one hand, and to droughts upon the other; but, when the water-supply is properly controlled by the arts of man, the soil is made to yield its most abundant returns; second, that, under the culture and protection of man, vineyards, orchards, and groves can be established over vast areas, where, under the control of nature, only deserts are found; third, the siroccos of the Great Plains cannot be tamed, but men may protect their homes, their gardens, and their fields from devastation by them; fourth, the lightnings of heaven cannot be employed to bring rain upon the plains, but electricity may be used to illumine the cities and towns and hamlets that must ultimately spring up over all that land."

HEALTH MATTERS.

Recovery from Lightning-Shock.

DR. J. B. PAIGE read before the Medico-Chirurgical Society of Montreal an account of a case of lightning-shock which resulted in recovery.

The accident occurred in Prescott, Mass., during a terrific thunder-storm, July 29, 1887, about five o'clock P.M.

Lightning struck the house, to all appearances the chimney of the upright part first. At the roof the current divided into three parts, one following the chimney down to the floor of the second story, then passed along a stove-pipe out of the chimney, and partly to a nail in the floor by the legs of the stove, and thence by the timbers to the earth. A second subdivision of the current followed a rafter on the north side of the roof, after leaving which it could not be traced. This rafter was completely torn from its place. A third current passed down a rafter on the south side of the roof. At the lower end it divided again, one portion following the finish of the roof, passed along the other side of the L to the opposite corner, followed the track of a rolling-door, and reached the earth by the corner post of the house. The other part coursed along the studding of the house, near the window, and passed to the earth. Attached by a screw to the upper casing of the window was a large iron hook on which was suspended, by a brass chain, a bird-cage. One part of the current, going by this chain to the bird-cage, left it at one corner, entered the body of the subject of the accident, and left the room by a nail in the floor.

That the electrical influence in this quarter was intense, is proved by the fact that the links of the chain in some places were nearly melted apart, while the solder at the corner of the cage, where the fluid left, was completely melted. Again, the nail by which it passed through the floor was considerably roughened. It appeared as if it had been partially melted at a high temperature.

The patient was thrown from the chair in which she was sitting, directly across another chair, a distance of two or three feet. She was taken out to the piazza immediately, and her condition was found to be as follows: completely unconscious; motionless; muscles relaxed; left eye closed, right open; face purple; pulse at wrist imperceptible; neither heart-sounds nor respiratory murmur to be heard.

Later, an examination showed the course of the electric current to be as follows: it struck the head above the left eye, midway between the eyebrow and hair, which was apparently the part nearest the corner of the bird-cage; passed along in front of the ear, then to the central line of the thorax, descending by the stocking-supporter, which was attached to the corsets; thence to the top of the stockings, leaving marks upon both limbs, but more especially upon the left, on the back of which, just above the knee-joint, was a burn about the size of one's hand. It had the appearance of an ordinary burn, and was only superficial. No trace of the current could be detected again until the foot was reached, from which it passed off by the joint of the great toe, tearing a place about two inches in diameter in the stocking and slipper, but not leaving the slightest mark upon the skin. With the exception of the burned spot on the posterior part of the left leg and one or two small burns on the body and the right leg, hyperæmic lines alone marked the course of the electricity in its passage over the body.

After removal of the patient to the piazza, the clothes about the neck and chest were loosened, and artificial respiration commenced.

In from three to five minutes the first sign of life appeared in the flexion of the right leg. The dark color disappeared from the face, and the pulse could be felt at the wrist. It was then weak, rapid, and irregular. The treatment was kept up for ten or fifteen minutes, until the body began to feel cold, when the woman was removed to the house, and placed upon a bed. The moving caused a disturbance of the circulation, as was shown by the pulse, which became very faint and fluttering. In order to encourage the circulation, hot fomentations were applied to the chest, and as soon as they became cold were replaced by fresh ones.

Soon a new train of symptoms set in. There was difficult respiration. The mucus and saliva, which were very abundant, had gravitated back, and could not be swallowed because of complete paralysis of the pharynx, etc. There was, in fact, paralysis of almost all the muscles of the uppermost parts of the body, including the arms. The symptoms were those exhibited by an animal when being asphyxiated: violent muscular contraction, difficult and forced respiration, etc. To remove the saliva and mucus, which caused the obstruction, the head and trunk were lowered. Handkerchiefs were also used. These were placed over the finger and passed back as far as possible into the throat, and in this way large quantities of the saliva and mucus were gotten away.

From one-half to three-quarters of an hour after the accident, consciousness began to return, and the muscles of the arm to regain strength. Sight was restored to the right eye, although it could not be moved. Though the subject could hear, she could not speak. This was shown by the fact, that, when asked to press the hand if she felt better, she responded. About this time paralysis began to disappear gradually from the tongue. Improvement continued: brief intervals of sleep were enjoyed through the night, and there was absence of any considerable pain.

In addition to the paralysis, the left eye was seriously affected. In discussing the case, Dr. Wesley Mills asked whether the patient would have recovered without the assistance rendered just after the accident. Considering that respiration was suspended, that the circulation, even with artificial respiration, was so feeble that the temperature fell, that consciousness did not return for so long, it does not seem reasonable to believe in the possibility of spontaneous recovery. But the case does seem to teach, in the clearest way, the importance of using such means as those employed in this instance promptly and perseveringly.

DEATH OF PROFESSOR PROCTOR.—That the disease from which the late Prof. Richard A. Proctor died was actually yellow-fever has been questioned by some of his friends. In order to determine the question, a post-mortem examination was made at the hospital on North Brother Island by Drs. T. Mitchell Prudden and H. M. Biggs, pathologists to the Board of Health, in the presence of Dr. Cyrus Edson chief inspector of contagious diseases, Health Commissioner Joseph D. Bryant, and others. The preliminary report of the examination, presented to the president of the Board of Health, is as follows: "Decomposition was so far advanced that it was impossible to arrive at a definite conclusion as to the cause of death. The organs presented no evidence whatever of pernicious remittent-fever, or other form of malarial disease, such as, even in the condition of decomposition presented by the body, would ordinarily be apparent. The only positive change due to disease which could be made out was in the kidneys, which showed the appearances of old, though not advanced disease. The alterations produced in the body by yellow-fever are usually of such a character as to be nearly or completely obliterated by advanced decomposition. We are therefore only able to say in this connection that there was no other evident cause of death, and nothing which could be incompatible with that disease. The final conclusion as to the cause of death must therefore, in our opinion, be largely based upon the clinical history."

PHYSICAL EXERCISE AMONG CELESTIALS.—A correspondent of the Shanghai North China *Herald* says that to the average Celestial it is a matter of indifference how long he remains in one position. He will write all day like an automaton, he will work from morn to eve without any variation and apparently without any consciousness of the monotony. The Chinese school-children will undergo an amount of confinement, unrelieved by recesses or changes

of work, which would drive a western pupil to the verge of insanity. Even Chinese infants are said to remain as impassive as 'mud gods.' To the Chinese, exercise appears to be superfluous, and they can sleep anywhere. With a brick for a pillow, the 'heathen Chinese' can lie down on his bed of stalks, or mud bricks, or rattan, and sleep the sleep of the just, with no reference to the rest of creation. He does not want a darkened room, nor does he require others to be still. The 'infant crying in the night' may continue to cry, for all he cares: it does not disturb him. In the case of most working-people, and also in that of many others, position in sleep is of no sort of consequence.

POISONOUS EFFECT OF PETROLEUM.—In a letter to the *Medical News*, Dr. W. H. Sharp of Volcano, W.Va., discusses the poisonous effects of petroleum. For nineteen years he has practised medicine in an oil town, surrounded by oil-wells, and in daily contact with laborers connected with the oil-industry. He says that in considering the effects of petroleum it is necessary to know clearly which kind of oil is indicated, as there are different grades of natural oil, which must have different effects as they are richer or poorer in the lighter products, as gasoline, benzene, naphtha, and carbon-oil. The heavier natural oils, of specific gravities ranging from 26° B. to 35° B., such as are produced in West Virginia at this point, in Pennsylvania at Franklin, and at a few other points, are very different in composition from the lighter petroleum oils which range from 35° B. to 50° B., such as are so largely produced in Pennsylvania and Ohio, and are used for refining for illuminating purposes. The former are almost devoid of the gasoline, naphtha, and benzene found in the latter, and do not make a satisfactory carbon-oil. Where this heavy oil is produced, there is found less gas than accompanies the light oils. The worker in these heavy natural oils runs no risk at any time from the inhalation of gas, even in the tank-sheds where the oil is stored, and the engineers at the pumping-stations of the transportation companies are exposed to no dangers from inhalation of gas. In all the light-oil districts serious accidents are quite frequent from the inhalation of gas. It is the practice to have the receiving-tanks at the wells closely housed with wooden sheds, at the roofs of which are ventilators for the escape of gas. This past spring an oil-man who had gone to North Baltimore, O., for work, was suffocated in one of these tank-sheds while making a run of oil; viz., running the oil from the receiving-tank to the transportation or pipe-line company's tanks. It is said that the men employed in this work by the transportation companies become somewhat accustomed to this gas, and can then remain longer exposed to it before feeling its effects. Oil-well drillers affirm that the sense of suffocation comes on very suddenly. When the gas is very plenty around drilling-wells, and if there be any delay in getting pure air, suffocation ensues. In the section around Volcano, even when drilling in light-oil territory, there is little danger from this, as the derricks are seldom tightly housed, as is the practice in other regions. Heavy lubricating-oils applied locally are not irritating: they are as bland to the skin as the best petroleum jelly or ointment. They have had a well-deserved reputation as soothing applications to burns and wounds: the heavier the oil, the better it is suited for this purpose. These oils do not irritate any inflamed surface, but relieve the pain as well as does the *linimentum calcis*, or white-lead dressing. The only disadvantages in its use are, that the cloths become stiff from drying, and the application is a dirty one, penetrating the bedding, etc., if applied freely. A light oil 40° to 50° gravity would probably prove irritating from the presence of benzene, etc. Internally these heavy natural oils have been used in pulmonary troubles, viz., bronchitis and phthisis; persons taking them in doses of from 1 to 4 f 3 several times a day. Dr. Sharp has never known or heard of any ill effects from their administration. He has made a careful search in the *American Journal of the Medical Sciences* since 1869, and in other journals, and finds only two cases of poisoning by petroleum recorded; viz., in the April number of the *American Journal of the Medical Sciences* for 1873, and in the *Medical Record*, Sept. 26, 1885. From these two cases petroleum would not seem to be very poisonous, and to be chiefly eliminated by the skin and kidneys, especially the latter, unchanged by transudation. That it is the lighter oils in the crude petroleum which produce the intoxicating effects, and that the *acne* seen in workmen is due to something used in the process of refin-

ing, are highly probable: certainly they do not arise from contact with the natural oils of the heavier gravities, viz., 26° B. to 35° B.

THE VALUE OF VACCINATION.—Zürich, according to *The Lancet*, is beginning to suffer from the effects of neglect of vaccination. Until 1883 a compulsory vaccination law was in force, but in that year it was repealed; the success of the anti-vaccinationists depending, it is said, upon the fact that not a single case of small-pox occurred in 1882. But in 1883, in every 1,000 deaths, 2 were caused by small-pox; in 1884 there were 3 in every 1,000; in 1885, 17; and in the first quarter of 1886 there were 85 deaths. While Europe is exhibiting folly by showing in some localities opposition to vaccination, Japan is deriving benefits from the recognition of its value. Nagasaki possesses a governor, named Kusaka, who is bent upon ridding the town of the diseases which formerly infested it. By means of a system of compulsory vaccination, rigorously enforced by the governor, small-pox, long a familiar scourge in the old town, has been practically stamped out. Germany, too, is showing the effects of revaccination, and hitherto the freedom of German towns from small-pox has contrasted in a marked degree with a larger prevalence of this disease in other European towns where revaccination is not enforced. Probably the outcome of the experience of the present generation will be the enforcement of revaccination in the majority of civilized countries.

ELECTRICAL SCIENCE.

Is the Velocity of Light in an Electrolytic Fluid influenced by an Electric Current in the Direction of Propagation?

THE following description of Lord Rayleigh's experiment on this subject is given in Professor Lodge's sketch of the papers read before the last meeting of the British Association:—

It is well known, that, when an electric current flows through an electrolyte, an actual transfer of matter accompanies it, — two opposite transfers, in fact, as evidenced by the continuous appearance and escape of the travellers, one at each electrode. It is also known by a refined experiment of Fizeau, confirmed by Michelson, that, when a beam of light travels down a stream of moving matter, its velocity is slightly increased; whereas, if light travels against a stream of matter, it is slightly retarded. These things being so, it may be held as probable, that, whenever the two ions taking part in an electrolytic current differ in momentum, a slight effect may be exerted on the velocity of light travelling with or against the current; but then, according to the calculations of Kohlrausch, confirmed by some experiments of Professor Lodge, the speed of the electrolytic ions is extremely small, the quickest being thirty microns per second, or about four inches an hour, for an applied slope of potential of one volt per centimetre.

The effect of such a creep as this was not what Lord Rayleigh looked for. It was quite within the range of possibility that the existence of an electric current in an electrolyte should so disturb the ether inside it as to produce quite a notable change in its index of refraction. Were such an effect discovered, it would be a distinctly new fact, not taken into account, or even rendered probable, by existing theories; and it is very well to have the question experimentally examined, and to a certain extent set at rest.

The method adopted was a beautiful interference arrangement of Michelson, whereby a beam of light is split up into two halves, which are sent along a certain route, or circular tour, and are then recombined into one at the point whence they originally split off, and are examined by a magnifying eye-piece. The result is a set of interference-bands more or less well defined. Tubes containing dilute sulphuric acid supplied with an electric current are then placed along the route taken by the two half-beams of light, so that one half the beam will be helped and the other half hindered by the current, if it produce any effect at all. The thing looked for is to see if the interference-fringes shift along microscopically when the current is supplied, stopped, or reversed. The result is negative; and, by considering carefully how much of an effect could have been certainly perceived if it had existed, the definite statement is made, that a current of intensity of one ampère per square centimetre through dilute sulphuric acid does not affect the velocity of light in its own direction by so much as one part in thirteen million, or by fifteen metres per second.

THE TUDOR ACCUMULATOR.—Some details of tests of the Tudor accumulator have already been given in this journal, but the following data are more complete than any hitherto obtainable. In the Tudor accumulators a crystalline coating of peroxide of lead is formed on the positive plates by a process that lasts two or three months, while the negatives are produced by the application of red lead, as in the ordinary types. Two of these cells, said to have been in use from November, 1881, to December, 1887, were tested by Prof. W. Kohlrausch. They were submitted to thirty-four charges and thirty-four discharges, there being a mean interval between the two of fifteen hours. The weight of the plates in a cell is 13.6 kilograms; the volume of the liquid, 3.4 litres; there are four positive plates with a surface of 12 square decimetres; the normal charging current is 5 ampères; discharge current, 6.5 ampères. The following figures give some results of the tests:—

	Charge.	Discharge.
Intensity of current.....	5.00	6.50
Difference of potential at terminals.....	2.15	1.88
Mean capacity.....	50.80 109.00	47.70 ampère hours. 90.00 watt hours.
Mean duration.....	10.16	7.35 hours.
Efficiency.....	{ 94 % in ampère hours. 82.40 in watt hours.	

The following figures are also of value in comparing with other types of secondary batteries:—

	Charged.	Discharged.
Density of liquid.....	1.147	1.115
Internal resistance.....	0.015	0.020
Current density per square decimetre.....	.417	.542
Capacity in ampère hours per kilogram of plate.....	3.500	—
Capacity in watt hours per kilogram of plate....	6.600	—

Let us compare the capacity and discharge-rate of this cell with a Julien cell, the weight of the plates being about the same. The figures given for the Julien cell are approximate.

	Tudor.	Julien.
Useful capacity (watt).....	90.0	190
Discharge-rate.....	6.5	20
Efficiency.....	82.4	70 (about)

The Tudor accumulator is, then, inferior to the well-known 'grid type' in storage-capacity and discharge-rate, — two very important factors. Its greater efficiency is partly due to the low discharge-rate. As far as length of life and ability to resist rough usage go, the Tudor cell is, if we are to believe the report, superior. The cells under test were said to have been in use for six years, and were in good condition. During the experiments they were several times allowed to become completely discharged — an operation that severely injures an ordinary cell — without apparent ill effect; and once the cells were completely reversed, and then charged again in the right direction, still without apparent injury. In considering the value of new types of accumulators, the main points to be considered are, leaving out questions of first cost, discharge-rate, length of life, storage-capacity, and ability to resist rough usage. In length of life and ability to resist rough usage the Tudor batteries seem to give better results than any for which reliable figures have been given. In storage-capacity and discharge-rate they are distinctly inferior to the ordinary type; and it is these defects, especially the latter, that render them unfit for traction-work, and for most cases of central-station lighting.

THE EMPLOYMENT OF MICA IN CONDENSERS.—Most of the condensers supplied for electrical measurements are made of sheets of tinfoil, separated by thin layers of mica. It is important to know whether the capacity of a condenser made in this way is constant, or whether it varies with the duration and amount of the charge. M. Klemencic has studied the specific inductive capacity of mica on which the capacity of the condenser depends. He used two sheets of the mineral .5 of a millimetre and .1 of a millimetre in thickness respectively, making two condensers with them, and comparing their capacity with that of a standard air-condenser, using different periods of charge and discharge, and different electromotive forces. The following table gives the results obtained:—

Electro-motive Force of Charge.....	Sheet of .5 of a Millimetre.		Sheet of .1 of a Millimetre.	
	$t=.00026$ sec.	$t=20$ sec.	$t=.00026$ sec.	$t=20$ sec.
1 Daniell.....	6.62	6.89	6.54	6.99
2 "	6.72	—	6.48	—
4 "	6.66	—	6.46	—
6 "	6.68	6.94	6.45	7.00
1 "	6.67	—	6.46	—
1 "	6.66	—	6.45	—

M. Klemencic also studied a condenser of .15 microfarads capacity formed of 19 sheets of mica of 15 centimetres square, with tinfoil between them. In the following table the figures under t_1 represent the time of charge; under t_2 , the period between charge and discharge. In one case 12 Bunsen cells were used in charging; in the other, 1 Daniell.

t_1	12 Bunsen t_2		1 Daniell t_2		
	.007 s.	2 s.	.007 s.	2 s.	60 s.
.002	3.494	3.478	3.572	3.543	3.461
.300	3.501	3.486	3.600	3.577	3.495
1.200	3.532	3.530	3.620	3.611	3.575
60.000	3.533	3.532	3.637	—	3.584

The numbers in the different columns are the ratios of the capacity of a standard air-condenser to those of the mica-condenser. If we take the values for $t_1 = .3$ s., and $t_2 = 60$ s., we will have about the actual case in practice, and none of the other values differ from it by more than one per cent: so, if M. Klemencic's results are correct, we can depend upon mica-condensers within that limit.

MENTAL SCIENCE.

Association by Contrast.

M. PAULHAN (*Revue Scientifique*, Sept. 1) calls attention to the widespread application of the law of contrast. This law he formulates as saying that every psychic state tends to be accompanied (simultaneous contrast) or followed (successive contrast) by an opposite state. An excellent instance of it in sensation is that of complementary colors; but it is equally applicable to feelings, thoughts, and beliefs. A physiological homologue is shown in the fact that a contraction of a muscle is not accomplished without the simultaneous innervation of its antagonistic muscle. The flexors are always opposing the extensors, and *vice versa*, and it is a properly adjusted opposition of the two that results in an accurately co-ordinated movement. In the higher psychic states the state must usually be long, and maintained with some difficulty, to have the contrast appear. In all hesitation we see a balancing of opposites, each argument *pro* at once calling up a parallel argument *contra*. The introduction of a new set of ideas at once arouses an opposite train of familiar thoughts. Objections that at first seem trivial and not worthy of attention gather force by brooding over

them. Again: all knowledge is relative, and epithets must be compared with their opposites: 'little' suggests 'big,' and 'big' is only relative to the 'little.' People differ very much in the readiness with which they take suggestions, in the difficulty with which the opposite train of thoughts arises. In hypnotism this 'contrasting' power is at a minimum, and very rarely does a concept suggest its opposite. In normal natures combativeness plays very variously important rôles. Morbid instances of this mode of mental action are also to be found. Griesinger records a case of a lady constantly saying just the opposite of her intentions. Some insane patients personify these contrast associations into internal voices controlled by rebellious spirits constantly suggesting the opposite of what they ought to do. Kussmaul describes a state as dysphasia in which the emotion is opposed to the words expressing it, and so on. All this illustrates the wide scope of this association by contraries, which same trait we recognize in its extreme moral-intellectual side as contrariness.

The principle of successive association finds an equally broad field of application. Its elusory illustrations are particularly good in sight (complementary colors, after-images), but are also present in taste (as when any thing tastes sour after eating sweets) and in almost all types of sensations. But we can find the same law in emotional states. Depression is the recognized after-effect of too jovial dissipation. In hypnotism there seems to be a definite alternation from one emotion to its opposite, that suggestion, or, according to some, the stimulation of a magnet, can excite. In fact, all such phenomena can be regarded as governed by the universal law of rhythm, one state recurring at regular intervals, filled in with states of an opposite character. Sleeping and waking, inspiration and expiration, illustrate the physiological aspect of the law. Darwin brings the sentiment of remorse following upon cruelty under the same law.

Under marked conditions such alternations of emotion are extremely frequent, and lie at the root of the hysterical diathesis. Periodic insanity showing exaltation followed by depression, the assumption of unworthy habits by most respectable patients, passionate outbreaks in peaceably disposed patients, — all these are not infrequent. Cases of dual consciousness are perhaps only intensified instances of such successive contrasts. In incipient insanity the dearest relations are often the objects of most intense antipathy.

Such phenomena of successive contrast as depend for their effect upon the presence of an interval since the experience was last made, are equally varied, and equally numerous. Eating after long hunger, re-union after long separation, success after long struggle, enjoyment after much care, — all these give especially great pleasure. Pleasures too often partaken of pale, and need the spice of contrast for their relish. Again: a privation always suggests a longing. When we are deprived of a convenience, we feel the need of it most. When circumstances prevent the realization of our wishes, the displeasure is at a maximum: witness homesickness. The fatigue of one set of emotions brings on the opposite set, perhaps; when continued too long, any state tends to lessen in intensity. Sometimes the feelings flit between sorrow and joy, and we have a curious mixture of the two, — a selfish comfort and a trying sympathy. All such considerations suggest, however sketchily, the existence of an underlying psychophysical law that makes the union of opposite psychic states especially significant.

HYPNOTISM AND CRIME.—Hypnotism as an aid to crime has been variously discussed in France from both the medical and the legal side, with the general conclusion that legislation is needed to cover the most palpable employment of it. The fact that a hypnotized subject can take and execute a criminal suggestion made by another, and yet be really innocent of any immoral intent, is beyond all doubt; and this fact has led observers to the conclusion that the blame must rest upon the giver of the suggestion. An additional precaution which the true originator of the crime might take would be to give a suggestion forbidding the subject to reveal to any one the name of the suggester or the fact of the suggestion. On the contrary, he was to say and feel that the act was committed of his own accord. This complicated the legal aspect of the question very seriously; but further experiments have shown that the instigator of the crime would not be so entirely safe, after all. M.

Jules Liégeois, who has studied most carefully the legal aspects of hypnotism, suggested to a lady subject that she take a pistol and shoot a certain Mr. O. She acted out the suggestion perfectly, not knowing that the load was a blank cartridge. When again hypnotized, she admitted the crime and defended her action. Another gentleman now gave her the suggestions (1) that when the instigator of the crime enters the room she should go to sleep for two minutes; (2) on awakening, she should fix her eyes upon the man constantly until allowed to desist; (3) she should then stand in front of him and attempt to conceal him. When M. Liégeois entered the room, she fell asleep, and did all that was asked of her, thus revealing the instigator, though told by him not to do so. Professor Bernheim induced a subject to steal, and forbade him to mention that he had been told to do it. The patient said he stole because the idea occurred to him, but, when told to go up to the true criminal and say, "Please sing me the Marseillaise," he did so. It seems, then, that the subject will do nothing that he has been categorically forbidden to do, but that he will succumb to an indirect mode of revealing the true instigator of the crime. This certainly aids the courts; but it is a question how far it will be of service when the true criminal is not present, and whether additional suggestions in the first instance will not considerably interfere with the reliability of later testimony. Its further development will be watched with great interest by all students of the scientific aspects of mental phenomena.

PSYCHIC EFFECTS OF HASHEESH. — Mr. A. M. Fielde has recently recounted his experiences under the influence of hasheesh. He smoked the hasheesh until he felt a profound sense of well-being, and then put the pipe aside. After a few minutes he seemed to become two persons: he was conscious of his real self reclining on a lounge, and of why he was there; his double was in a vast building made of gold and marbles, splendidly brilliant, and beautiful beyond all description. He felt an extreme gratification, and believed himself in heaven. This double personality suddenly vanished, but re-appeared in a few minutes. His real self was undergoing rhythmical spasms throughout his body: the double was a marvellous instrument, producing sounds of exquisite sweetness and perfect rhythm. Then sleep ensued, and all ended. Upon another occasion sleep and waking came and went so rapidly that they seemed to be confused. His double seemed to be a sea, bright, and tossing as the wind blew; then a continent. Again he smoked a double dose, and sat at his table, pencil in hand, to record the effects. This time he lost all conception of time. He arose to open a door: this seemed to take a million years. He went to pacify an angry dog, and endless ages seemed to have gone on his return. Conceptions of space retained their normal character. He felt an unusual fulness of mental impressions, — enough to fill volumes. He understood clairvoyance, hypnotism, and all else. He was not one man or two, but several men living at the same time in different places, with different occupations. He could not write one word without hurrying to the next, his thoughts flowing with enormous rapidity. The few words he did write meant nothing. This experience admirably illustrates the close relationship between states of real insanity and transitory affections induced by psychic poisons.

BOOK-REVIEWS.

Elementary Political Economy. By EDWIN CANNAN. London, Henry Frowde. 16°. (New York, Macmillan, 25 cents.)

THIS little book is designed to set forth the rudimentary truths of political economy, and in some respects it is quite successful. Though containing only a hundred and fifty pages, it touches most of the fundamental facts and doctrines of the science, and explains some of them as clearly as could be expected in so small a compass. It is divided into three parts: the first treating of production; the second, of exchange and distribution; and the third, of the economic functions of the State. Mr. Cannan, however, seldom uses the familiar terms 'production' and 'distribution,' but employs roundabout expressions instead, — a practice that seems to us the reverse of commendable. He also avoids the term 'wealth,' using the phrase 'useful material objects' instead, and this phrase is re-

peated through his pages almost *ad nauseam*. Another fault in a work meant for beginners is the obscurity of the style in certain parts, as, for instance, in the sections on profits and wages; though in other parts the style is quite clear. Some important topics, too, such as the law of agricultural rent, are overlooked. The book seems to have been rather hastily prepared, and, in spite of some excellent qualities, is not what an elementary treatise on economics ought to be.

Report of the Geological Survey of Ohio. Vol. VI. Economic Geology. Columbus, State. 8°.

THE sixth annual report of the State Geological Survey of Ohio appeared early in the present year. The material for publication was partially ready in 1885, entirely so in 1886, and should have been published in 1887. This furnishes another illustration of the many difficulties with which science has to contend in bringing the results of its work before the public, when dependent upon legislative action.

Valuable matter accumulates, and remains in the hands of the publisher for long periods, which, if presented to the public at once, would be of great assistance to workers in other fields, and oftentimes prevent time and money being spent on questions which had already been solved.

The present volume is devoted entirely to economic geology, and principally to the subjects of oil and natural gas, nearly six hundred pages out of about eight hundred being taken up with descriptions of their modes of occurrence, their geological relations, and the methods of obtaining and handling them. Much of the matter has already been made public in a preliminary abstract by the State geologist and various papers in scientific journals.

The whole work teems with facts which are not only of interest to the scientist, but of great advantage to the practical workers in coal and gas as well.

After a general review of the geology of the State, in which its formations are shown to extend from the Trenton limestone as a base to the Upper Barren Coal-Measures, the more prominent theories of the origin of gas and oil are discussed, and compared with the phenomena observed in the Ohio fields. Discarding entirely the theory of chemical origin, it is maintained that petroleum is derived from organic matter, more largely vegetable than animal, but both; that it is derived from both shales and limestones; and that in the Ohio fields it has been produced at normal rock temperatures, and not by distillation. "The stock of petroleum in the rocks is already practically complete," is the reply to the question, so often asked, "Is the supply inexhaustible?"

Till 1884 the Trenton limestone was not considered a productive oil-bearing horizon. The discoveries of that year, however, in western Ohio, at once gave it a high rank. Beginning with the Findlay field, where the discovery was first made, and where, out of eighteen wells complete to April, 1886, but one had proved non-productive, the work extended through other portions of the State, the areas next in order of importance being the Lima and Bowling Green fields. The quality of the gas compares more than favorably with that of Pennsylvania; it furnishes a very valuable fuel; and its discovery has greatly increased the development of manufacturing interests in that section, while the growth of population has been correspondingly rapid.

In the eastern portion of the State, the oil-producing rock is the Berea grit, a subdivision of the sub-carboniferous. Its structural features, however, are not such as to favor the accumulation of paying quantities of gas or petroleum; and, although a very large number of wells have been sunk, with few exceptions they are entire failures.

In the central counties and those bordering Lake Erie to the north-east, the Ohio shale furnishes a small but very persistent flow of gas, which has become of considerable economic importance. But while this shale is also rich in oil, it is not obtainable in sufficient quantities to make it valuable.

A separate chapter is devoted to a description of the Macksburg oil-field, one of the earliest to be worked, and still very productive. The productive area is confined to a small anticlinal in the Berea grit, outside of which all wells have been complete failures.

Of the methods of drilling, and the care of the wells during

operation, a complete description is given, with diagrams of the machinery and tools used.

The transportation and uses of gas, its value as a fuel, the measurement of the wells, and the methods of piping, are described in detail.

The remaining pages of the report are devoted to the two principal coal-fields of the State, the manufacture of salt and bromine, cements, land-plaster, lime, etc.

Few of the States so thickly burdened with drift as is Ohio have so thorough a record of its depth over extended portions of their territory. Here it has been obtained by the drilling of the numerous oil-wells so fully, that a fair knowledge of the relief of the ancient preglacial surface of the State now exists. While in the northern counties the drift is of little thickness, in the western and central sections it at times reaches extraordinary depths, being in one case no less than five hundred and thirty feet thick.

Chambers's Encyclopædia. New ed. Vol. II. Beaugency to Cataract. Philadelphia, Lippincott. 8°.

ABOUT half a year has elapsed since the issue of the first volume of this new edition of Chambers's well-known Encyclopædia. Among the contributors we notice the names of many prominent scientists and literary men, and therefore we feel assured that the articles are in every respect a source of trustworthy information, and that they are up to date. The volume is profusely illustrated, and the illustrations are well selected. The maps have been made by Bartholomew and Johnston, and are up to the standard of the maps of their institutes. The present volume contains many interesting articles, among which we mention one on 'Bees,' by J. Arthur Thomson; 'Bimetallism,' by J. S. Nicholson; 'Blindness,' by F. J. Campbell; 'Bulgaria,' by A. Silva White; 'Robert Burns,' by Andrew Lang; 'Carboniferous,' by J. Geikie; and several military articles by Major Dunlop, R.A. The encyclopædia is well edited, the articles being carefully selected, and a judicious amount of space being allotted to the various subjects, according to their importance. The interests of the English and American public receive equal attention in this encyclopædia. Numerous articles might be quoted on account of the large amount of information conveyed in a small compass, and still well written. Among these we mention the article 'Bokhara,' which is principally founded on Vambéry's book of that country. Of special interest to the American public is the long article on 'Canada,' by J. G. Colmer, which is accompanied by two elaborate maps, — one of the Dominion, and the other of the eastern provinces. The article gives a brief review of the geography, commerce, and history of the province. The article 'California,' which is also accompanied by a map, has been written by Charles W. Greene. This, as well as other articles on subjects of special interest to America, has been copyrighted by the publishers. Among these are an interesting sketch of the Beecher family, and sketches of the cities of Boston, Brooklyn, Buffalo, and Cambridge. The remarkable career of John Brown the abolitionist is sketched. Other American men whose life and work are described in this volume are Artemus Ward (C. F. Browne), W. C. Bryant, Buchanan, Benjamin Franklin Butler, and John Caldwell Calhoun.

The National Revenues: A Collection of Papers by American Economists. Ed. by ALBERT SHAW. Chicago, A. C. McClurg & Co. 16°. \$1.

Is Protection a Benefit? A Plea for the Negative. By EDWARD TAYLOR. Chicago, A. C. McClurg & Co. 16°. \$1.

THE tariff question has now become the leading issue in American politics, and bids fair to remain so until it is definitely settled. The dispute between free-traders and protectionists has been in abeyance for some years past, owing to the greater prominence of the slavery question and the difficulties that grew out of it; but it has now arisen again, and in a more decisive form than ever. It presents itself, too, in a different form from that which it bore in the early part of the century. Then the protectionists advocated a high tariff only as a means of establishing manufactures, with the avowed intention of reducing it to a revenue basis at a later time; but now they desire to retain it as a permanent policy. What will be the ultimate outcome of the dispute that has now begun is a

question with which we have here no concern, but there can be no doubt as to the importance of a correct understanding of the problem itself. Nor is it sufficient that the leaders of the people alone should understand it; for the appeal of both the parties in controversy is to the mass of voters, and by them it must be decided.

Under these circumstances, every book or essay that really teaches anything on the subject is to be welcomed, and such works are already beginning to appear in considerable numbers. The titles of two of them stand at the head of this article; and both works have considerable merit, while at the same time neither can be called quite satisfactory. The first is a collection of twenty brief essays — some of them very brief — dealing with all aspects of the revenue question, and not with the tariff alone. The editor is a young student and writer on economic subjects, and the authors of the essays are mostly recognized authorities on the subjects of which they treat. The principal fault of the book is the extreme shortness of some of the articles, which hardly allows room for an intelligent expression of opinion, and wholly precludes reasoning. It would have been far better, in our opinion, to have had a much smaller number of longer and more argumentative papers. However, there is a good deal that is suggestive in the book, and it may stimulate the reader to further investigation. The majority of the writers favor a reduction of the tariff, and all of them oppose the repeal of the liquor and tobacco taxes; Professor Thompson of Pennsylvania, though an ardent protectionist, agreeing on this point with the free-traders. Another noticeable feature of some of these essays is the favor with which the writers regard schemes for spending the surplus revenue for internal improvements, and even for distributing it among the States, this last being a measure of very doubtful constitutionality, and of equally doubtful expediency. We have no space to speak of particular articles; but the names of Professors Walker, Ely, Adams, Laughlin, and others, Carroll D. Wright of the National Labor Bureau, and many competent writers besides, are a sufficient guaranty that the book is of real value in spite of its scrappy character.

The second book on our table is an argument for free trade by an ardent and well-informed writer. The reasoning is not so close and thorough as we find in the best English writers on the subject, — a remark that applies to most American works on economic themes, — but it presents the arguments for free trade quite fully, and in a plain and simple style. The author opens his work with a brief history of the protective system both in Europe and in America, but the greater part of the volume is devoted to a discussion of the question as it presents itself to-day.

In a few cases Mr. Taylor presses his conclusions, perhaps, a little farther than the premises warrant; but, as a rule, his reasoning is sound, and his answers to the protectionist arguments are in the main apt and conclusive. With regard to the contention that our national prosperity is due to the tariff, he shows that we were never more prosperous than under the low tariff prevailing from 1846 to 1860, and that our great prosperity is really due to other causes, with which neither protection nor free trade has anything to do. Again, the protectionists have long maintained that protection raises wages, and that the high wages prevailing in this country are due to it. In reply to this, Mr. Taylor shows, that, although wages are lower in free-trade England than in the United States, they are much lower still in the protected nations of the European continent; and that Russia, which has the highest tariff of all, has also the lowest rate of wages; and his inference is that high wages are due to great natural resources and high efficiency of labor. The author gives chapters to the effect of the tariff on our foreign trade and shipping, to its bearing on the agricultural interest, and, indeed, to nearly all the aspects which the question presents. Such works as these two, notwithstanding some defects, can hardly fail to stimulate thought and discussion among the people, which alone can lead to the prevalence of right views, and to a final and satisfactory settlement of the controversy.

The Building of the British Isles. By A. J. JUKES-BROWNE. New York, Scribner & Welford. 12°.

THE restoration of the geography of past periods is a problem of peculiar interest; and one of the great aims of the science of geology is to reconstruct the history of development of the conti-

nents. In the present volume the author attempts to study the history of the British Isles. Although the available material is far from being complete, the long-continued and thorough researches in this narrow field enable the student to trace the more recent history with comparative exactness, while, on account of the incompleteness of the geological record and the difficulties of explaining the observed facts, the history of the ancient periods appears in many instances hypothetical. The author traces the history of the British Isles through all periods successively. Each chapter is illustrated by an interesting map showing the restored geography of that period, thus giving a clear insight into the probable history of development of this part of the globe. In each period first the physical conditions are discussed under which the rocks were formed, while the latter are described only so far as is necessary for ascertaining whence their component materials were derived, in order to form some conception of the relative positions of land and water during each of the successive periods of geological time. The maps of the more recent periods are based on the theory that the alternate rising and sinking of the area of western Europe was comparatively uniform, and therefore the present contour-lines appear as boundaries of the continent of those periods. The author's representation of pliocene geography differs from previous restorations in extending the area of land in Scotland and around the Faroe Islands. For the early pleistocene time the author assumes the eighty-fathom line to be the coast-line, while the land from that time on continues to sink. He favors throughout the theory that the oceanic basins are not absolutely permanent, and his conclusions are based on his studies of the history of the British Isles, which he has so comprehensively represented in the present volume. He thinks that the absence of deep oceanic deposits among the paleozoic rocks may be taken as indicative of a great difference in the general relations and proportional areas of land and sea, the probability being that there were neither oceans nor continents like those which now exist, but an irregular distribution of comparatively shallow seas among land-tracts of moderate elevation. In neozoic times proof of the existence of oceans is found, though these do not seem to have been so deep as those of the present day. That there were also large tracts of continental land is proved by the traces of large rivers and large inland lakes; but, so far as we know, these land-tracts did not form the nuclei of the modern continents of Europe, Asia, and Africa, or bear any definite relation to these continents. From this he concludes that the deep oceanic basins and lofty mountain-ranges of the modern world have been formed by a long process of evolution, the tendency of all recent geographical changes having been to deepen the ocean-basins, and to raise the mountain-peaks to higher and higher elevations. In the discussion he dwells on the theory of the formation of the English chalk, and against other authorities maintains that it has probably been formed in a deep sea.

American Commonwealths. Indiana. By J. P. DUNN, jun. New York, Houghton, Mifflin, & Co. 16°. \$1.25.

THE author of this work has seen fit to close it with the admission of Indiana into the Union as a State in 1816, but for what reason we are unable to see. The history of the State, and of its share in national affairs, is surely as important as that of the Territory; and the account that Mr. Dunn here gives us has the appearance of a fragment. It is true that it fills a volume as large as the others of the series to which it belongs; but this is only effected by diffuseness of style, and prolixity of narrative, — faults that we have noticed in some other volumes of the series. Then the map at the beginning of the book is singularly inappropriate to this work; since it shows Indiana as it is now, while the narrative relates entirely to the territorial period. Notwithstanding these defects, however, the work has considerable merit. The author shows familiarity with his subject, carefulness in collecting facts, and an evident desire to be just to all persons and parties; and he evinces a patriotic interest in his State without undue partiality.

The history of Indiana, as far as it is related by Mr. Dunn, naturally divides itself into two periods: the first embracing the early exploration and settlement of the country; the second, the later colonization from the Eastern States and the political contests among the people. The first settlements were those of the French,

who passed down the Wabash on their way from Canada to the Mississippi and New Orleans. The most important of their posts, and for a long time the capital of the whole region, was Vincennes, which Mr. Dunn thinks was founded in 1727, though the date is uncertain. The growth of population was for a long time so slow, that in 1800 the white people of what is now Indiana numbered only about twenty-five hundred, and the extent of the immigration from the East and South is shown by the fact that in 1815 the number was over sixty-three thousand. Mr. Dunn's account of the early French inhabitants brings before us a state of society that has long since passed away, and is one of the most pleasing features of the book. The most important part, however, as the author clearly perceives, is the struggle over the admission of slavery into the Territory. The famous ordinance enacted by Congress in 1787 forbade slavery in all the region north and west of the Ohio; but this was construed to apply only to persons born in or immigrating into the Territory after the ordinance was passed; and those who were slaves at the time of its passage remained so. The French settlers, however, and some of those from the Southern States, wanted to re-establish slavery, and repeatedly petitioned Congress to repeal the slavery proviso, which Congress steadily refused to do. But at length the anti-slavery men became a majority in Indiana; and when the State entered the Union its Constitution contained a provision prohibiting slavery forever. Besides these leading themes, Mr. Dunn's pages convey a good deal of information on minor matters; and particular attention is given to men like La Salle, Vincennes, Governor Harrison, and others, who were prominent in Indiana's early history.

PUBLISHERS' FALL ANNOUNCEMENTS.

Ginn & Co.

'A Pamphlet of Parallel References,' prepared by John Williams White of Harvard College, to adapt his 'First Lessons in Greek' to the Hadley-Allen 'Greek Grammar,' will be published the latter part of October. A new edition of Allen & Greenough's 'Latin Grammar' will be published in November. The book has been entirely re-written; but the sections of the new edition will correspond with those in the old, so that the two can be used together. 'The Brutus of Cicero,' edited in the College Series of Latin Authors, by Prof. Martin Kellogg of the University of California, will be published in December. A new edition of Professor Byerly's 'Integral Calculus' may be expected in November. 'The History of Greek Philosophy,' by B. C. Burt, formerly fellow and fellow by courtesy in the Johns Hopkins University, will be published the 1st of November. 'A General Astronomy,' by Prof. C. A. Young of Princeton College, will be published the latter part of December. It is a college-book, and will be fully illustrated with cuts and diagrams. 'Footprints of Travel, or Journeyings in Many Lands,' by M. M. Ballou, author of 'Due West,' 'Due East,' etc., will be published early in November. This is a volume of geographical readings, presenting vivid pictures of countries visited by the author. *The London Classical Review* has enlisted the co-operation of leading American scholars, and Ginn & Co. are to be the American publishers. 'Voices of Children,' by W. H. Leib of Kansas City, will be published in November. 'Teacher's Handbook of Arithmetic,' by G. C. Shutts of the Whitewater (Wis.) Normal School, will be published early in December. A new edition of Lanman's 'Sanskrit Reader' may be expected the latter part of October. This will include the long-promised notes, and the notes will also be put in a separate volume. 'The Beginner's Book in German,' by Miss Sophie Doriot, will be issued in December. This is to be a companion volume to Miss Doriot's 'Beginner's Book in French,' which has been so highly commended. An edition of 'Tom Brown at Rugby,' authorized by Mr. Hughes, will be published in the series of Classics for Children in about two months.

E. L. Kellogg & Co.

The list of books for teachers now embraces fifty titles. The new ones now ready are, 'Gardner's Town and Country School Buildings,' containing twenty-five designs of schools of all grades, but specially of country schoolhouses, with 150 illustrations;

'Southwick's Quiz Manual on Theory and Practice of Teaching'; 'Welch's Talks on Psychology,' by A. S. Welch of Iowa; 'Welch's Teachers' Psychology' (ready in November); 'Dewey's How to teach Manners,' by Mrs. J. M. Dewey; Teacher's Manuals Series, four new numbers (ten numbers in all), — 7. 'Huntington's Unconscious Tuition,' 8. 'Hughes's How to keep Order,' 9. 'Quick's How to train the Memory,' 10. 'Hoffmann's Kindergarten Gifts.'

A. C. McClurg & Co.

'Montesquieu,' by Albert Sorel (The Great French Writers Series), translated by Melville B. Anderson; 'Astrophel and Stella,' by Sir Philip Sidney, edited by Alfred Pollard, with portrait of Sidney; 'Shelly: The Man and the Poet,' by Felix Rabbe; 'Victor Cousin, the Distinguished French Philosopher, Orator, and Educator,' by Jules Simon of the French Academy (The Great French Writers Series), translated by Melville B. Anderson and Edward Playfair Anderson; 'The Standard Symphonies: their Stories, their Music, and their Composers,' a handbook, by George P. Upton; 'Manual of the Vertebrate Animals of the United States, including the District North and East of the Ozark Mountains, South of the Laurentian Hills, North of the Southern Boundary of Virginia, and East of the Missouri River, inclusive of Marine Species,' by David Starr Jordan, president of the University of Indiana (fifth edition, entirely rewritten and greatly enlarged); 'Turgot,' by Léon Say of the French Academy (The Great French Writers Series) translated by Melville B. Anderson.

Charles Scribner's Sons.

The first volume of the 'Cyclopædia of Music and Musicians,' edited by John Denison Champlin, jun., with William F. Apthorp of Boston as critical editor, stands at the head of the list. The work will consist of three quarto volumes, this edition being limited to five hundred numbered sets for this country, and fifty for England. An important feature of the work will be the illustrations. Modern art has been so influenced by the French schools of painting, that a new work which analyzes and traces to its source this influence will be sure of a hearty welcome. Such a work is Mrs. C. H. Stranahan's 'A History of French Painting.' The reminiscences, sketches, and comments of the Hon. Hugh McCulloch are especially noteworthy for the information they contain regarding the 'Men and Measures of Half a Century.' The second volume of 'Around the World on a Bicycle' carries the adventurous rider, Thomas Stevens, across Asia from Teheran to Yokohama. The sixth volume of Dr. Philip Schaff's 'History of the Christian Church' deals with the German Reformation between 1517 and 1530. 'Dogmatic Theology,' by Dr. William G. T. Shedd. A new and revised edition of Corea, by William Elliot Griffis, who has brought this popular book about 'The Hermit Nation' down to date. In 'Little People of the Meadows, Woods, and Waters,' by Stella Louise Hook, the author describes the lives of familiar insects. The popularity of Miss Wright's two previous volumes, 'Children's Stories of American Progress' and 'Children's Stories in American History,' insures a cordial reception for her new book, 'Children's Stories of the Great Scientists.' New and cheaper editions are announced of Charles F. Holder's three books, 'Living Lights,' 'Marvels of Animal Life,' and 'The Ivory King,' the general title for the set being 'Marvels of Animal Life Series.' Boys will also be interested in 'Wild Men and Wild Beasts,' by Colonel Gordon-Cumming.

Scribner & Welford.

D'Anvers's 'Elementary History of Art,' with a preface by Prof. Roger Smith (new edition in 2 vols.). 'Francis the First and his Times,' by Julia Pardoe, with numerous portraits and illustrations on steel (new edition). 'Louis the Fourteenth and Court of France in the Seventeenth Century,' by Julia Pardoe (new edition). 'Life of Matthew Fontaine Maury,' compiled by his daughter, Diana Fontaine Maury Corbin, with portrait. 'Leaves from an Egyptian Note-Book,' by Isaac Taylor, LL.D., canon of York. 'Tropical Africa,' by Henry Drummond, F.R.S.E., F.G.S., with six maps and illustrations. 'Caldecott's North Italian Folk,' sketches of town and country life, by Mrs. Comyns Carr, illustrated by Randolph Caldecott. 'Princetoniana: Charles and A. A. Hodge, with Class

and Table Talk of Hodge the Younger,' by a Scottish Princetonian, the Rev. Charles A. Salmond, M.A., Rothesay, with portraits, etc. Vol. II. of 'History of the Christian Philosophy of Religion,' by Professor Pünjer, translated by W. Hastie, B.D., with an introduction by Prof. Robert Flint. 'The Hibbert Lectures, 1887,' lectures on the origin and growth of religion as illustrated by the religion of the ancient Babylonians, by A. H. Sayce. In Bohn's Libraries, 'Lucian's Dialogues,' 'Julian the Emperor,' 'History of Prose Fiction,' by John Colin Dunlop; 'Lives of the Tudor and Stuart Princesses,' by the late Agnes Strickland; 'The Building of the British Islands, a Study in Geographical Evolution,' by A. J. Jukes-Browne; and 'Plutarch's Morals.'

Miscellaneous.

The 'Eclectic Shorthand Dictionary,' by Prof. J. George Cross, M.A., was published Aug. 18, by S. C. Griggs & Co., Chicago. This book is supposed to be particularly beneficial to beginners on account of the phonic spelling given. — The eighth volume of Alden's 'Manifold Cyclopædia' extends from 'Ceylon' to 'Club-Foot.' — In the *Andover Review* for October, Professor Stoddard, of the University of California, draws a comparison between two important and opposing tendencies of literature represented by Tolstoi and Matthew Arnold; Professor James, of the University of Pennsylvania, considers 'Manual Training in the Public Schools in its Economic Aspect,' and he argues forcibly for its introduction into our educational system; there are editorials upon elementary education in England and Wales, etc. — 'The Effects of Protection,' by Charles S. Ashley, will be the leading article in *The Popular Science Monthly* for November (it is an important contribution to the tariff discussion, showing the expensiveness of protection, the small number of those benefited by it, its failure to keep up wages, its influence in checking our export trade, and its effect in making us "a nation of liars," and our government a heedless spendthrift); the question how long man has lived in America, and what were the surroundings of the primeval inhabitant, will be discussed in an illustrated article, entitled 'Paleolithic Man in America,' by W. J. McGee; the vice-presidential address given by Charles W. Smiley before the American Association, on 'Altruism Economically considered,' will be published; and 'The Prolongation of Human Life' will be treated by C. M. Hammond. — Gen. A. W. Greely, chief signal officer, has written for the November *Scribner's* an article entitled 'Where shall we spend our Winter?' which will be of great value to invalids and pleasure-seekers. — Brentano's will publish immediately Sir Morell Mackenzie's work in relation to the case of the late Emperor Frederick, embodying his reply to the German physicians. The book will have not only value to the medical profession, but great interest to the general public. A facsimile letter of the dying Emperor Frederick, and other illustrations, will be given in the volume. — The Euclid Publishing Company of Chicago will issue in a few days 'The History of the Bank of England,' by Joseph Hume Francis. — Thomas Whittaker will publish shortly the next volume in the Camelot Series, 'Irish Fairy-Tales and Folk-Lore,' selected and edited by W. B. Yeats; in the Great Writers Series, 'Life of Crabbe,' by T. T. Kebbel. — D. Appleton & Co. have just published the fifth volume of 'Appletons' Cyclopædia of American Biography.' They have also just issued an 'Index to Appletons' Annual Cyclopædia' for the twelve volumes, 1876-87. — James Clegg, Rochdale, Eng., has just published his 'Directory of Second-hand Booksellers, and List of Public Libraries, British and Foreign.' Besides the lists of booksellers and libraries, Mr. Clegg gives a list of fictitious names used by authors and illustrators; ancient centres of printing, with their Latin equivalents; bibliographical works of reference; journals of the book-trade; copyright registry; etc. The book may be obtained in this country through B. Westermann & Co. — The latest addition to the list of Volapük journals is the *Van Kua Tung Hua*, published in China by a Chinese. The paper prints the Chinese characters and the translation in Volapük. The object will be to teach the Chinese Volapük, and Chinese to those who understand the 'universal language.' — The first number of *Our Young Folks' Monthly*, the organ of Our Young Folks' Reading-Circle, has been issued. Mr. S. R. Winchell of Chicago is managing editor.

NOTES AND NEWS.

THE University of Texas at Austin has instituted a school of geology, which is conducted by Robert T. Hill. It is intended to arrange two classes, — one for those who desire a general knowledge of geology, and the other for those who wish to become practical geological investigators and teachers. A circular has been issued in which the programme of the school is fully set forth.

— The rapid development of Southern California has brought Lower California into prominence, and recent explorations have shown that it is not at all that desert land which it has long been supposed to be. In a book by Charles Nordhoff, 'Peninsular California,' recently published by Harper & Brothers, the merits of the northern section of the territory are set forth. This district belongs to the Mexican International Company of Hartford, Conn., which attempts to found colonies there, and to promote agriculture. Nordhoff's volume is accompanied by interesting illustrations, showing the character of the vegetation of that region, and views of beautiful orchards and wooded mountains. In an appendix meteorological data are given, and the timber region and recent gold discoveries are described.

— Mr. Samuel H. Scudder, Cambridge, Mass., will shortly publish an extensive treatise on the 'Butterflies of the Eastern United States and Canada, with Special Reference to New England.' The preparation of this work was first announced by the author in 1869, in the *American Naturalist* and other journals of the day. It has thus been twenty years in progress, and represents eight years of undivided attention to its elaboration. In this long time the author has not only availed himself of the personal aid of a host of willing friends and correspondents, who have confided to him their voluminous field-notes and numerous specimens, but he has carefully gleaned every fact of value from the natural-history journals and other publications, and supplemented all by his thirty-five years' experience in the field. No systematic work on butterflies has ever appeared in any language comparable with it in the complete elaboration of a single limited fauna, in attention to every stage of life, thorough and excellent illustration of every period of the butterfly's existence, and in careful detail of all structural features. It contains 17 plates of butterflies, 6 of eggs, 11 of caterpillars, 2 of the nests of caterpillars, 3 of chrysalids, 2 of parasites, 33 of structural details in all stages of life, 19 maps and groups of maps to illustrate the geographical distribution of the butterflies, and 3 portraits of early naturalists of this country, — in all, about 2,000 figures on 96 plates, of which 40 or more are colored; the butterflies in a style of chromolithography never surpassed, if it has ever been equalled in similar illustrations, whether in Europe or America. The printing of the plates was begun three years ago, and is now nearly completed. The work will be issued in twelve monthly parts, to be sold at five dollars per part, or fifty dollars on or before Jan. 1, 1889, for the complete work.

— A prize of one hundred and fifty dollars will be awarded by the American Economic Association for the best essay on 'The Evil Effects of Unrestricted Immigration.' This prize is offered by *America*, the new Chicago weekly; and the essay will be known as the 'America Prize Essay.' Any person is eligible to competition, provided his article does not exceed twenty-five thousand words, and is received by the secretary of the association before April 30, 1889. Each essay must be type-written, signed by a fictitious name, and accompanied by a sealed envelope containing the name assumed as well as the address of the author. For further information, address the secretary, Prof. R. T. Ely, Johns Hopkins University, Baltimore, Md.

— The collection of papyri of Archduke Rainer has been the subject of careful researches. J. Wiesner has made a microscopical and chemical inquiry, while J. Karabacek studied it from an historical point of view. The results of their inquiries shed an entirely new and unexpected light upon the history of the manufacture of paper. It is shown that the art of making paper of linen was first carried to Samarkand by Chinese captives in A.D. 751, when the governor of Samarkand made war upon the princes of Ferghana and Shash, who were tributaries of China. Wiesner as well as Karabacek shows that cotton paper, which was generally assumed

to have been the first paper manufactured, never existed. In Samarkand the manufacture of paper from linen rags was invented by Persians, and this invention gave a great stimulus to the manufacture. Samarkand papers were famous all over the Orient and Occident until the eleventh century. Later on, factories were established in Bagdad and Egypt, and it was then that paper took the place of the ancient papyrus. The researches of Wiesner show that these early papers were white, and that they were filled and sized by means of starch. It is of great interest that Wiesner's conclusions as to the methods of manufacture of the early papers have been fully confirmed by the recent discovery of an ancient Arabian manuscript describing the manufacture of paper in detail. Cotton was never used for making papers in those early days.

— The *Naturwissenschaftliche Rundschau* gives an abstract of an interesting lecture of Ch. André, who has made a series of experiments on magnetic disturbances. It is well known that magnetic disturbances originate on the whole earth simultaneously, and that they are caused by the action of the sun. Ch. André found that they originate when a place of disturbance on the sun passes its apparent centre. He says, "If by a continuous series of observations the successive situations of regions of activity on the sun are determined, which either appear as spots or *faculae*, or only as *faculae*, it will be seen that every great magnetic disturbance coincides with the passing of this region through the apparent centre of the sun. Those among these regions which remain for several revolutions of the sun on the same spot, cause a magnetic disturbance every time they pass the centre of the sun, while no disturbances are observed when no such region is on that spot of the sun's surface lying between his centre and that of the earth." This phenomenon occurs so regularly, that André was enabled to predict a disturbance as soon as a spot appeared on the eastern limb of the sun.

— The 'Fifth Annual Report of the Ohio Meteorological Bureau' contains, besides the usual summaries, a few interesting phenologic tables, the first being a statement on the migration of birds as observed at Wauseon, Fulton County, in 1887, by Thomas Mikesell. It contains the dates of arrival and departure of seventy-five species of birds, with notes on the frequency of their occurrence. The next table gives phenological observations on forest and other trees, the date of the opening of buds, the time when the trees are in leaf and in blossom, and the ripening of the fruit. The change of foliage and the falling-off of the leaves are also noted. Besides this, we find tables giving the dates of the blooming of plants. Work of this kind is highly welcome to the student of biology, as well as to the geographer. There are at present forty-one stations in operation, reporting to the Ohio Meteorological Bureau.

— In the signature of the Proceedings of the United States National Museum just issued, Mr. George F. Kunz gives an interesting account of the meteoric iron which fell in Johnson County, Ark., on March 27, 1886. The report is remarkable on account of the great care bestowed by the writer upon ascertaining the history of the fall as observed by eye-witnesses. A thorough description of the iron is given. Its upper side is ridged and deeply indented, being in many places almost tin-white, while the lower side is flat and covered with large, shallow pittings. The writer concludes, that, after entering our atmosphere, the iron travelled with the ridged surface forward, the iron burning so rapidly as to be torn off, leaving part of the surface bright. The flame thus passed over the sides, and, the indented edge being downward, the flame was driven upward as the iron advanced. The flat side not being so much exposed, the iron was not so completely consumed, hence a crust and large but shallow pittings. These conditions would perhaps have been entirely different had the mass been round or thicker, for it evidently moved as straight as possible without rotating at all. That it was found in the earth with the flat side down, was due perhaps to the fact that it turned after losing its highest velocity.

— The fifth annual convention of the Iowa Assembly of the Agassiz Association was successfully held at Mount Pleasant, Aug. 21, 22, and 23. Representatives from fourteen chapters were present, making the largest representation in the history of the assembly.

Five chapters were admitted to membership. The first day of the convention was devoted to committee-meetings, addresses, and reading of papers. In the evening a reception and banquet was tendered to the delegates by Chapter 700, at the home of Miss Crane. The second morning was given to the president's address, competition for diplomas, reading of papers on modes of work, and exhibition of specimens. In the afternoon the assembly visited the Iowa State Hospital for the Insane, and were shown through the institution by Dr. F. P. Peck, who in the evening delivered before the assembly a very interesting and profitable lecture entitled 'Notes on the Anatomy of the Brain.' The usual convention picture was taken during the afternoon. The third and last day of the convention was devoted, in the morning, to the reading of papers, debate, and miscellaneous business; in the afternoon, to awarding the diplomas, general business, and election of officers. Diplomas awarded for the best records of work done during 1887-88 were as follows: first, to Chapter 653, of Oskaloosa; second, to Chapter 20, Fairfield; third, to Chapter 812, Davenport. Officers elected were: John G. Speilman, Chapter 20, Fairfield, president; Fred B. Palmer, Chapter 653, Oskaloosa, vice-president; Fred M. Irish, Chapter 285, Dubuque, 2d vice-president; Miss Olive Cole, Chapter 700, Mount Pleasant, secretary; Belmont A. Goam, Mount Pleasant, continuing in office as treasurer. Oskaloosa was chosen as the place of the next convention. Enough praise cannot be given to the members of the entertaining chapter, A.A. 700, for their hospitality and good management, which has made the fifth annual convention of the Iowa Assembly of the Agassiz Association a meeting which will never be forgotten.

— The Congress of Americanists, devoted to researches into the pre-Columbian history of this continent and into the languages and character of its aboriginal tribes, met in Berlin on the 2d instant. We may be able to give some account of the proceedings in a future number. The next meeting will be held in Paris in 1889. It is hoped that arrangements may be made for a meeting of this learned body in the United States. An error occurred in the telegraphic announcement of the opening, last week, which mentioned "Horatio Hale of Clinton, Ontario," as among the members present. Mr. Hale was not able to be present, but sent a communication to be read by another member. The appearance of his name in the printed list of contributors doubtless led to the error.

— One of the annoyances connected with the use of instruments containing lenses, in the examination of the cavities of the body, is due to the fact that they become dim by the deposition of moisture. Dr. Stocquart claims that this can be prevented by spreading a drop of glycerine on the lens.

LETTERS TO THE EDITOR.

A Notable Evolution.

YOUR number of Sept. 7 coming to hand yesterday, I find in it a letter under the above title, from Mr. E. P. Powell, that seems likely to mislead those not informed on the subject. After the statement that "every one knows what a clumsy singer" the robin is, it goes on to describe the peculiar musical powers now noted in some few individuals. The mere fact of such great rapidity occurring in the robin's musical evolution would of itself cause suspicion that the former state had not been well observed. Now, the fact is, that the robin is not, and for several years has not been, a clumsy singer, when it wishes to exert itself. That it is not as constant a songster as the majority of song-birds may be accounted for by its lazy habits, remarked by Mr. Powell. It is quite true that its more common notes are quite unmusical in character, but in noting any song-evolution it will not do to overlook its other, not infrequent song. It is now some fourteen years since I first began to collect birds and study them in a practical manner. I am positive that at the beginning of that time the robin was no mean songster. From five to seven o'clock in a summer or early fall evening it is an almost daily occurrence for them to take their stand on the topmost bough of some tall tree, and for an hour or more pour forth a flood of melody. This song isn't a repetition of a "rough seesaw note," but a variety of very liquid notes rendered in a most musical manner. Nor is this song confined alone to the evenings, but

may often be heard during the day. Such, at least, were the robins of Rochester, N.Y., and many other localities with which I was familiar for the past fourteen years. Whether any change has taken place there within the past year, I cannot say, for I have not been within hearing distance of a robin for that time.

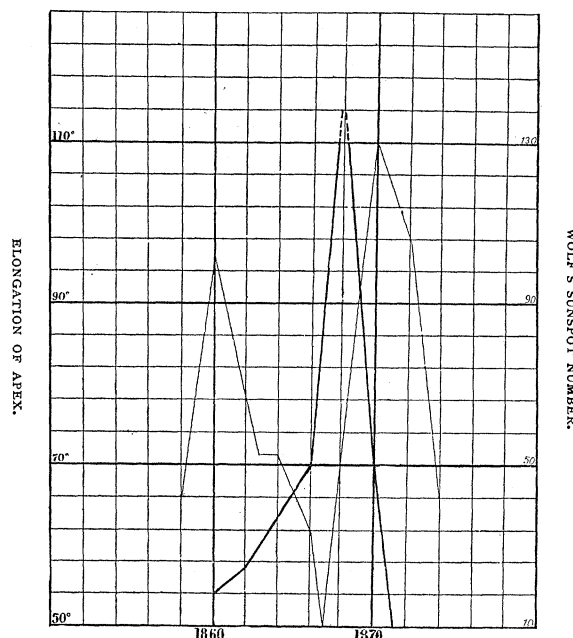
Mr. Powell's stricture on Professor Baird's remark about the catbird strikes me as a trifle unfair. It can't be supposed that Professor Baird was unacquainted with the mimicking-powers of this bird. The merest tyro in ornithology, who lives anywhere in their vicinity, must be acquainted with this. What Professor Baird stated was perfectly true as far as it went; for their 'mewing' is *the* characteristic note: hence the name 'catbird.'

HENRY L. WARD.

Tacubaya, D.F., Mex., Sept. 20.

The Zodiacal Light.

A DISCUSSION of the long series of observations on the zodiacal light by Heiss and Weber (1843-83), and also a ten-year series by Backhouse, having shown a clear connection between the extent of the zodiacal light and the condition of the solar surface, as is shown in the following curves drawn from observations made by Backhouse, in which the heavy line indicates the mean yearly elongation



of the zodiacal light, and the light line the course of Wolf's relative sunspot numbers, I am, for the sake of other connections foreshadowed, anxious to obtain as many observations of the zodiacal light as possible. The material is, however, badly scattered, and compels me to ask through your columns that any who know the whereabouts of such observations would kindly call them to my attention.

O. T. SHERMAN.

Baltimore, Md., Sept. 29.

Periodicity of Thunder-Storms.

THE researches of Von Bezold in regard to a periodicity of thunder-storms corresponding to the time of the rotation of the sun, referred to in *Science* for Oct. 5, on p. 167, corroborate the results secured by the writer. In certain years this periodicity becomes more evident. In 1886 for months together it was very plainly apparent upon the most cursory examination. In other years more complete information from wider areas has been necessary in order to bring it out clearly. It seems to me strange that any one should ignore facts because their full significance may not be clearly understood at present. The note which you publish in regard to Von Bezold shows that he was inclined to do this, and this tendency appears to be specially difficult to overcome in the investigation of this subject.

M. A. VEEDER.

Lyons, N.Y., Sept. 8.